Civil Defense

Procurement and Use of Blood, Blood Derivatives and Plasma Expanders in a Major Disaster

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On June 15, 1955, a major attack by enemy aircraft was made by surprise on California. The invaders succeeded in reaching their targets and dropped atomic bombs on the large cities. In one city alone, it was reported that 180,000 people were killed and 177,000 were casualties. The combined total was approximately 40 per cent of the inhabitants of that city. Other urban centers suffered equal destruction. Fortunately, the above statistics are only the realistic figures tabulated by the Civil Defense authorities after the simulated attack.

The hypothetical destruction of the city, the bleak desolation, and the tremendous loss of life are impossible to envision; but the figures cited are probably quite factual, as they are based on findings obtained by the actual past use of the smaller weapons of destruction. If the largest bombs which are now available had been dropped, it is conceivable that the killed and injured would more closely approximate 60 to 80 per cent of this state's population. If such a catastrophe occurred, thousands of our people would die for the very simple reason that there would not be enough blood instantly available to care for them. Blood is outdated after 21 days, and the stocks that would be in the ice boxes of blood banks would probably be destroyed or contaminated. We must assume that there would be very little usable whole blood in the entire state.

It is not intended that this short article should exactly define the specific uses of blood, plasma, other blood derivatives, and plasma expanders. Every physician should know the full therapeutic value of these different transfusion commodities. We recommend a refresher perusal of one of the recent books written on transfusion therapy. Physicians who served in the last war know full well the tremendous value of blood, plasma and serum albumin in the mass treatment of badly wounded service personnel. Suffice to say that if there is enough blood of the proper type in the proper place at the proper time, the likelihood of saving patients is tremendously enhanced.

A constant problem in blood banking is to create ways and means to make sure that no person in peace or war shall die because of the lack of blood.

President of the California Blood Bank System.

The chart on the adjoining page presents a condensed table on the usage of blood and its derivatives.

The population of California now is 12 million. Supplies of blood available for therapeutic purposes are adequate and are conveniently placed. Approximately 310,000 units of blood are used per year. There are 12 banks operating within the framework of the California Blood Bank System, two Red Cross Regional Blood Centers, several small hospital blood banks, and three commercial laboratories currently drawing blood for use in the state. Los Angeles and Orange counties with their combined five million are the areas which use the most blood at present. No state in the nation has a more completely integrated, coordinated blood coverage system than California, but like all medical ancillary public services, the blood program cannot remain static; it is not perfect, it is being continually improved.

Earlier planning in the location of blood banks is turning out better than could have been expected for they are widely dispersed throughout the length and breadth of the entire state. These banks mesh and interlock with each other. They serve definite territories and stand ready to implement their neighbor institutions' need for blood and thus provide better transfusion protection for all communities. This well-integrated plan has worked well, and for the first time in medical history it has made blood instantly available anywhere in California or procurable within a few hours. However, this system would break down under the stress and mass destruction incident to atomic bombings. Supplementary long range measures must be formulated speedily and effectively to solve this pressing problem.

The Federal Civil Defense Administration Bulletin No. 184 (dated May 24, 1955) estimates that the number of living casualties following an air attack on the five major target cities of our state would be over one million. The blood that would be needed during the first ten hours would be 100,000 units, from 10 to 72 hours 940,000 units, and from four to 21 days 1,150,000 units. This large figure equals the quantity of blood that now is drawn by all of

THERAPEUTIC CHOICE FOR USE INTRAVENOUSLY

A = First Choice, B = Second Choice, C = Third Choice, D = Fourth Choice, E = Fifth Choice

	WHOLE BLOOD		PLASMA			RESUSPENDED RED CELLS	HUMAN SERUM ALBUMIN	ANTIHEMOPHILIC GLOBULIN	GELATIN*
	fresh	preserved	liquid	frozen	dried				
SHOCK, HEMORRHAGIC	A	A	B	B	B	D	C		E
SHOCK, BURN[1] OR CRUSH SYDROME[1]	B	B	A	A	A		C		D
SHOCK WITH CEREBRAL HEMORRHAGE	B	B	C	C	A[4]		A[4]		D
SHOCK, MEDICAL[3]	B	B	A	A	A		C		D
ANEMIA, ACUTE	A	A				B			
ANEMIA, CHRONIC	B	B				A			
LEUKOPENIA[2] OR THROMBOCYTOPENIA[2]									
HYPOPROTEINEMIA, ACUTE[3]	D	D	C	C	B[4]		A[4]		
HYPOPROTEINEMIA, CHRONIC[3]									
CARBON MONOXIDE POISONING OR METHEMOGLOBINEMIA	B	B				A			
COMPLEMENT OR PROTHROMBIN DEFICIENCY	B	B[5]	A[6]	A[7]	A[7]				
HEMOPHILIA	B	C	B[6]	B[7]	B[7]			A	
IMMUNOTHERAPY	B	B	A[8]	A	A				

[1] Initial treatment
[2] No treatment with blood recommended
[3] Several causes (cf. text)
[4] Concentrated
[5] Stored less than 10 days
[6] Fresh liquid plasma
[7] Plasma quickly stabilized after collection
[8] Plasma stored less than 3 months

*Since the above table (taken from "Blood Transfusions" by DeGowin, Hardin and Alsever: W. B. Saunders Co., Philadelphia, 1949) was printed, the choice of gelatin for intravenous purposes has changed. Dextran and polyvinylpyrrolidone (PVP) appear to be more suitable in the role of plasma volume expanders.

the blood banks within the state in a three-year period. Realistic thinking can only conclude that a massive loss of life would result even if only a five megaton multiple strike were inflicted.

In order to show the tremendous physical plant and the great expansion of trained administrative and technical personnel that would be necessary in our blood banks to meet this challenge (presupposing that by some miracle the banks were spared), the following example is outlined (based on statistics from FCDA Advisory Bulletin No. 184):

1. If 1,150,000 units of whole blood are required four to 21 days (a 17-day period) following a major disaster of the five target areas:
   (a) Approximately 67,647 units of whole blood would be required per day (24 hours).
   (b) Approximately 2,819 units of whole blood would be required per hour.

2. If one team of 105 workers, using 20 beds, could draw and process 100 units of blood per hour:
   (a) Approximately 28 teams (2,940 personnel) would be required to draw and process 2,819 units of blood per hour.

3. If three eight-hour shifts are required per 24 hours, and a different team is used each shift:
   (a) Approximately 84 teams (8,820 personnel) would be required to draw and process 67,647 units of blood per day.

Based on the previously mentioned estimate of 177,000 casualties for one city alone (where blood bank has a present maximum monthly capacity of 12,000 units) the bank would have to increase its production 22 times in order to supply the estimated 265,500 units of blood required in a four-week period (1.5 units per living injured).

Blood banks in the past have grown, through necessity, to their present maturity in the larger population centers. This logical development was geared to the greatest source of donor supply and recipient demand. During peace, this is a good working relationship. However, during a massive bombardment from the air, or from any other large scale disaster, not only would the cities and towns be completely obliterated, but so would the large blood banks which now give these urban areas complete blood coverage. Seven of the largest banks are situated in the middle of our metropolitan zones and would, therefore, be close to ground zero. One bank is located at the periphery of epicenter, and two lie directly in the fall-out path. Only four blood banks might escape destruction. Two of these four are the smallest banks in the system, and the other two are listed as medium sized banks.

The logical deduction, then, is that the present large urban banks of the state would simply cease to exist just at the time when their commodity is most needed. It appears obvious that we should disperse these vulnerable blood banks and get them sufficiently far outside of the strike area in order that these facilities would not be destroyed and their trained personnel scattered. If this plan is not feasible, then we ought to organize and create satellite banks on the safe perimeter of the larger centers so that in case of need these satellite banks could go into immediate operation. To do this would require financing not immediately available. All 12 of our community, nonprofit blood banks are entirely dependent for their existence on the small service charge made for their services. They just do not have sufficient money to create such an all encompassing network of satellite banks, erected, equipped and staffed, even on a stand-by basis.

In California, communities differ widely from one another in topography, transportation routes, weather, food and water supplies, ease of speedy access to or egress from the area and even in the nationality of the inhabitants. Each site assumes a complexion of its own; hence any overall blueprint for a major disaster must be broken down to the needs of the particular locality. In some measure this is good for it places the responsibility directly on each community to do something for itself in planning, implementation and creating safety measures. Certainly this is true in blood banking. The rapid dispersal of the inhabitants of the central California valleys would be comparatively easy as contrasted to the impossibility of mass evacuation from the San Francisco area, where also the primary routes of escape run mostly into the dangerous fall-out areas to the southeast. It is fallacious to assume that each community will have four to six hours of warning before attack, permitting necessary medical blood procurement facilities to be removed to predesignated population collection centers along the escape routes where they could commence blood procurement as soon as the first onrush of escapees arrived at the holding stations. That does not take into account the hysteria, the confusion, the disorientation and the emotional behavior of the displaced people.

The California Civil Defense authorities have dispersed throughout the state over 32,000 units of blood plasma, 273,000 empty vacuum bottles with donor and recipient sets and adequate anti-A and anti-B typing serum. Augmenting this large reserve of plasma, the Federal Civil Defense Administration has stored within the state, for emergency use, 86,856 units of normal human dried plasma, a large quantity of vacuum bottles, donor and recipient sets, and a sizable amount of plasma volume expanders in the form of dextran and polyvinylpyrrolidone. These extensive stockpiles are now protected against ordinary bombings, but improved conservation plans are at present under way to make these valuable supplies even less vulnerable. In addition to the state and federal civil defense supplies, there are 5,200 units of plasma belonging to the blood bank sytem. These units are now strategically placed in various hospitals or in the banks' own storehouses.

The first ten hours following a major disaster are the most crucial. These few hours would see very little definitive medical treatment carried out. First aid would be the order of the day. Plasma, serum albumin and plasma expanders would be immediately utilized as these products are available in considerable amounts. The numerous first aid stations throughout the state have been equipped by civil defense, and all carry considerable supplies of these intravenous therapeutic agents. Accessory stores would be quickly mobilized and sent to the stricken areas.

If any whole blood is to be given during these critical early hours, it must of necessity come from sources outside the strike and fall-out zones. On them would fall the burden of drawing, checking and transporting blood on demand to the damaged areas. States adjacent to California, if unharmed themselves, would be called upon to augment the supply of blood, plasma and blood derivatives. This plan calls for an immediate close integration with the states surrounding ours to the east and north. Fortunately, both the California Blood Bank System's clearing house and the American Red Cross have established close reciprocity with the nation's blood banks.

On the bright side of the ledger are the following:

(a) Thousands of our people have previously donated blood. They are typed and carry their type card identification. The inmates of our penal institutions and state hospitals likewise are typed. This great reservoir of listed specific type blood would be available for instant use if the institutions were undamaged.

(b) Mobile procurement facilities are quite widely dispersed—a feature of great importance. They would be alerted for instant action.

(c) Some administrative and technical volunteer personnel have already been trained. This is particularly true of the two Red Cross installations, and as some of these volunteers live outside the critical strike areas, they would be thrown into action immediately.

(d) A considerable stockpile of plasma and plasma expanders is instantly available. This enormous cache would be the first material to be used after the disaster.

(e) Adjacent states and the country at large would rally immediately and respond with blood and plasma. Certainly the entire nation would not be irreparably damaged. The American National Red Cross blood centers and other out-of-state blood banking agencies would instantly come to our aid.

(f) Refugees in the large collection and holding centers would be spot-checked and the type O blood drawn. In this early phase no attention would be paid to the Rh factor. Later, when some semblance of order was established, type-specific needs could be furnished on demand from these holding zones. If necessary, complete blood procurement teams would be flown in from outside banks.

To augment plans by which we might be better prepared to face major attack sufficient sums of money must be made available for the creation of a well coordinated blood bank administrative and technical training program, for the education of the population in disaster blood procurement techniques, and for the creation of an intermeshing network of widely dispersed satellite blood banks. Without this financial assistance, the blood bank system must necessarily run along on its present schedule—which is adequate for peacetime needs. Given sufficient monetary aid, real progress toward disaster expansion could be achieved.

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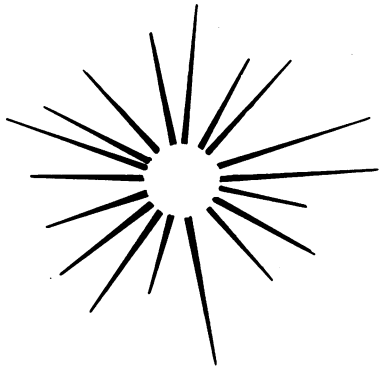


WITH WARNING

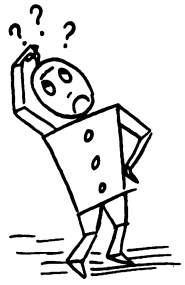
IMMEDIATELY REPORT TO YOUR CIVIL DEFENSE ASSIGNMENT

IF THIS IS NOT POSSIBLE, REPORT TO THE NEAREST MEDICAL INSTALLATION

WITHOUT WARNING

TAKE IMMEDIATELY AVAILABLE COVER. DO NOT LOOK AT THE BRILLIANT FLASH. IF IN CAR AND NO SHELTER AVAILABLE, STOP AT CURB, CLOSE ALL WINDOWS, TURN CAR RADIO ON, LIE ON FLOOR OF CAR.

AS SOON AS POSSIBLE CARRY OUT CIVIL DEFENSE ASSIGNMENT.



M.D.

WHAT TO DO?

KNOW YOUR C.D. ASSIGNMENT. LEARN ALL ABOUT C.D.